

Please check the examination details below before entering your candidate information

Candidate surname

Other names

**Pearson Edexcel
International GCSE**

Centre Number

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Candidate Number

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Friday 10 January 2020

Morning (Time: 2 hours)

Paper Reference **4PM1/01**

Further Pure Mathematics

Level 2

Paper 1



Calculators may be used.

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
– *there may be more space than you need.*
- You must **NOT** write anything on the formulae page.
Anything you write on the formulae page will gain **NO** credit.

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

Turn over ►

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Pearson

International GCSE in Further Pure Mathematics Formulae sheet

Mensuration

Surface area of sphere = $4\pi r^2$

Curved surface area of cone = $\pi r \times$ slant height

Volume of sphere = $\frac{4}{3}\pi r^3$

Series

Arithmetic series

Sum to n terms, $S_n = \frac{n}{2}[2a + (n - 1)d]$

Geometric series

Sum to n terms, $S_n = \frac{a(1 - r^n)}{(1 - r)}$

Sum to infinity, $S_\infty = \frac{a}{1 - r}$ $|r| < 1$

Binomial series

$(1 + x)^n = 1 + nx + \frac{n(n - 1)}{2!}x^2 + \dots + \frac{n(n - 1)\dots(n - r + 1)}{r!}x^r + \dots$ for $|x| < 1, n \in \mathbb{Q}$

Calculus

Quotient rule (differentiation)

$$\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{f'(x)g(x) - f(x)g'(x)}{[g(x)]^2}$$

Trigonometry

Cosine rule

In triangle ABC : $a^2 = b^2 + c^2 - 2bc \cos A$

$\tan \theta = \frac{\sin \theta}{\cos \theta}$

$\sin(A + B) = \sin A \cos B + \cos A \sin B$

$\sin(A - B) = \sin A \cos B - \cos A \sin B$

$\cos(A + B) = \cos A \cos B - \sin A \sin B$

$\cos(A - B) = \cos A \cos B + \sin A \sin B$

$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$

$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$

Logarithms

$\log_a x = \frac{\log_b x}{\log_b a}$

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Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 The n th term of an arithmetic series is t_n and the common difference of the series is d .

Given that $t_2 + t_9 = 0$ and that $t_4 + t_6 + t_{10} = 14$

(a) (i) show that $d = 4$

(ii) find the first term of this series.

(4)

A different arithmetic series A has first term 24 and common difference 6

For series A , the sum of the first $2n$ terms is 3 times the sum of the first n terms.

(b) Find the value of n .

(5)



Question 1 continued

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Question 1 continued

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(Total for Question 1 is 9 marks)



P 5 9 9 3 8 A 0 5 3 6

2 (a) On the grid below, draw the line with equation

(i) $5x + 2y = 10$

(ii) $y = x$

(2)

(b) Show, by shading on the grid, the region R defined by the inequalities

$y \leq x$

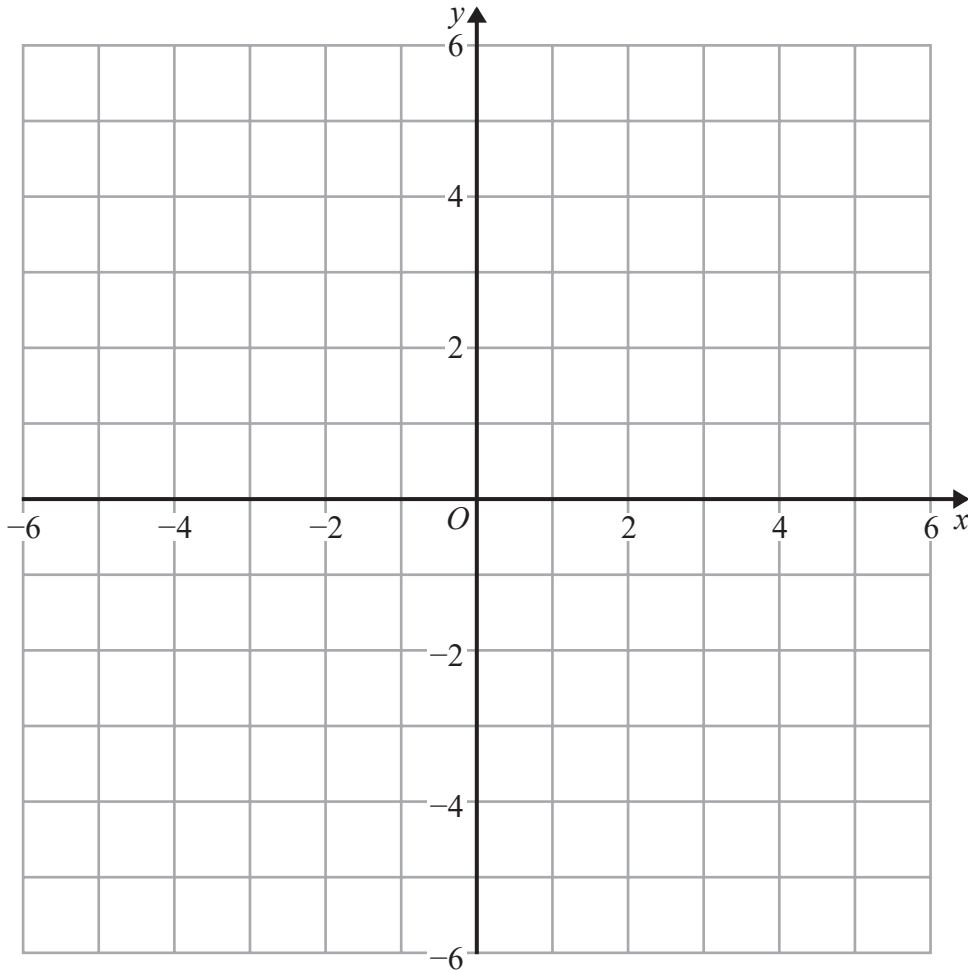
$5x + 2y \leq 10$

$y \geq -2$

$x \geq 1$

Label the region R .

(2)



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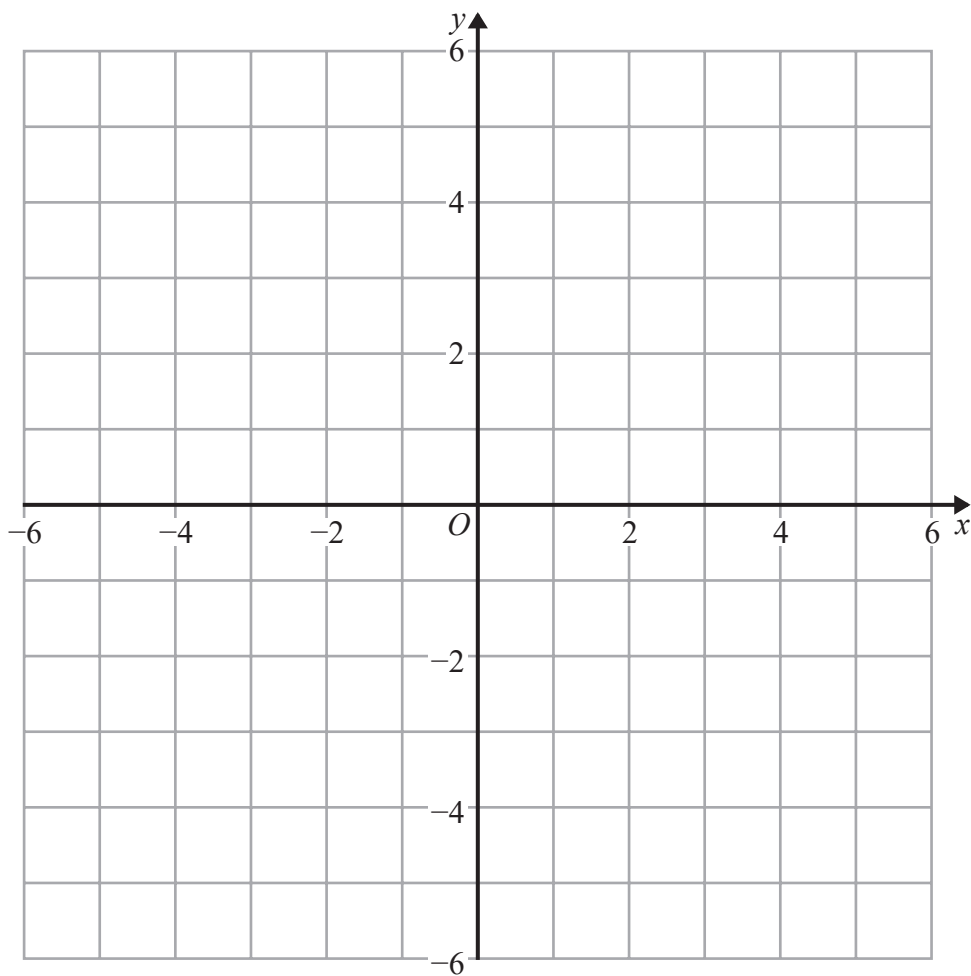
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Question 2 continued

Only use this grid if you need to redraw your graph.



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(Total for Question 2 is 4 marks)



3 Given that $(x - 4)$ is a factor of $px^3 - 31x^2 + 25x + 12$ where p is a constant,

(a) show that $p = 6$

(2)

(b) Solve the equation $6x^3 - 31x^2 + 25x + 12 = 0$

Show clear algebraic working.

(4)

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Question 3 continued

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(Total for Question 3 is 6 marks)



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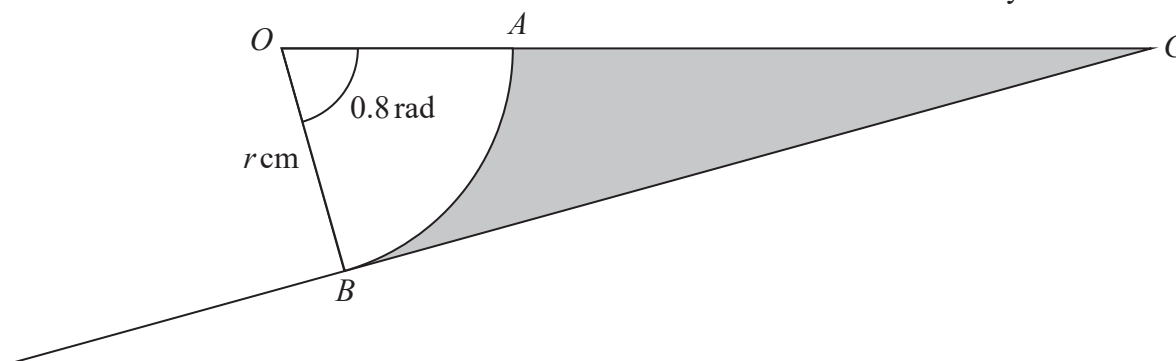


Figure 1

Figure 1 shows a sector *AOB* of a circle with centre *O* and radius *r cm* and a triangle *BOC*. The angle of sector *AOB* is 0.8 radians. The points *O*, *A* and *C* lie on a straight line so that *CB* is the tangent to the circle at *B*.

Given that the area of the shaded region in Figure 1 is 101 cm^2 , find the value of *r*.
Give your answer correct to 3 significant figures.

(6)

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Question 4 continued

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(Total for Question 4 is 6 marks)



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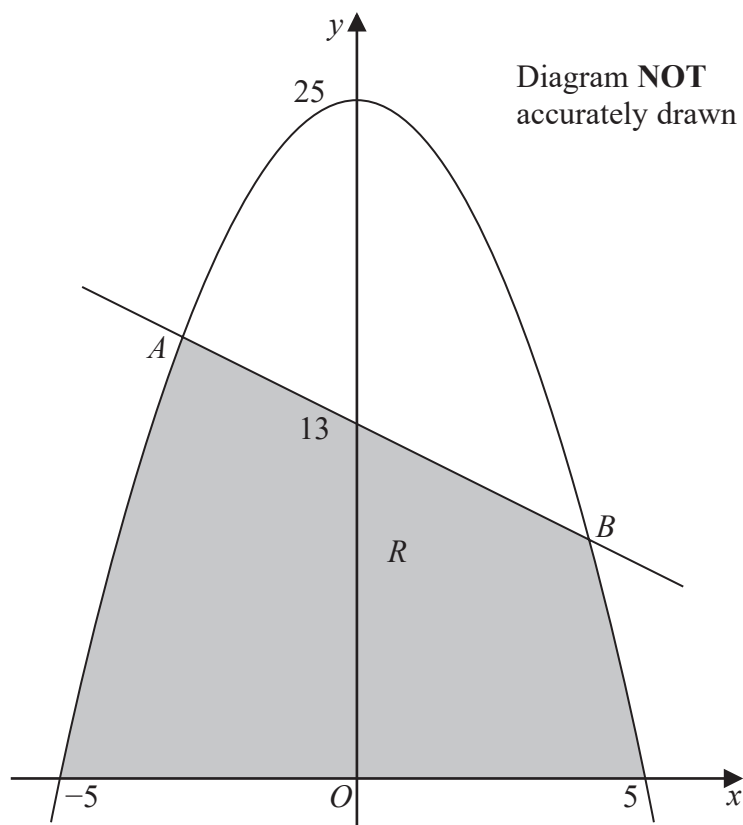


Figure 2

Figure 2 shows part of the curve with equation $y = 25 - x^2$ and part of the line with equation $y + x = 13$

The curve and the line intersect at the points A and B .

- (a) Use algebra to find the coordinates of A and the coordinates of B . (4)

The region R , shown shaded in Figure 2, is bounded by the curve, the straight line and the x -axis.

- (b) Use algebraic integration to find the area of R . (7)

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Question 5 continued

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Question 5 continued

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Question 5 continued

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(Total for Question 5 is 11 marks)



6 The point A has coordinates $(3, 0)$ and the point B has coordinates $(2, 2)$.
The line L_1 passes through B and is perpendicular to AB .

(a) Find an equation of L_1

Give your answer in the form $ax + by + c = 0$

(5)

The line L_2 with equation $x - 7y - 3 = 0$ intersects the line L_1 at the point C .
The midpoint of AC is M .

(b) Find the coordinates of M .

(5)

(c) Find the area of the triangle ABM .

(4)

Dotted lines for writing answers.

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Question 6 continued

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Question 6 continued

Area with horizontal dotted lines for writing.

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Question 6 continued

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(Total for Question 6 is 14 marks)



7 Solve the equation

$$\log_7(8x^2 - 6x + 3) - \log_{49}x^2 = 3 \log_7 2$$

(5)

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Question 7 continued

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(Total for Question 7 is 5 marks)



8 (a) Solve, to the nearest integer, the equation

$$\sin(2x - 75)^\circ = -0.515 \quad \text{for } 0 \leq x < 180 \tag{3}$$

(b) Giving your solutions to one decimal place, where appropriate, solve the equation

$$2 \tan y^\circ + 5 \sin y^\circ = 0 \quad \text{for } 0 \leq y \leq 180 \tag{4}$$

(c) Explain mathematically why there are no values of θ that satisfy the equation

$$3 \cos^2 \theta^\circ - 3 \sin^2 \theta^\circ + \sin \theta^\circ + 12 = 0 \tag{4}$$

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Question 8 continued

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Question 8 continued

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Question 8 continued

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(Total for Question 8 is 11 marks)



9 (a) Expand $\sqrt{1 - 4x}$ in ascending powers of x up to and including the term in x^3 , giving each coefficient as an integer.

(3)

(b) Use your expansion with a suitable value for x to obtain an estimate of $\sqrt{0.76}$ Give your answer correct to 4 decimal places.

(3)

(c) Hence find, to 3 decimal places, an estimate of $\sqrt{19}$

(2)

A series of horizontal dotted lines for writing answers.

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Question 9 continued

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Question 9 continued

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Question 9 continued

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(Total for Question 9 is 8 marks)



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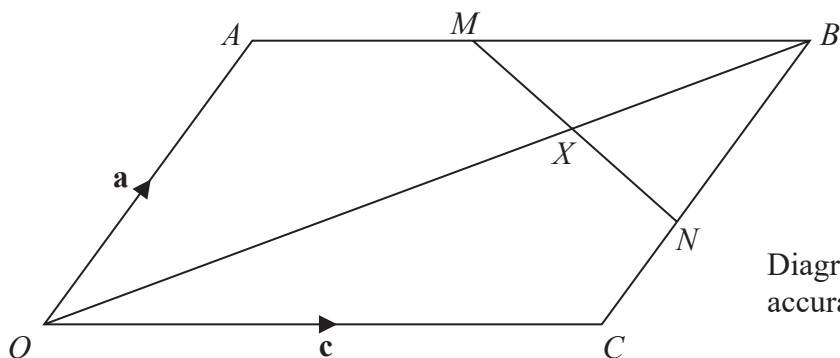


Diagram NOT accurately drawn

Figure 3

Figure 3 shows the parallelogram $OABC$

$$\vec{OA} = \mathbf{a} \quad \vec{OC} = \mathbf{c}$$

The midpoint of AB is M and the midpoint of BC is N .

The line OB intersects MN at the point X .

(a) Find in terms of \mathbf{a} and \mathbf{c} ,

(i) \vec{OB}

(ii) \vec{MN}

(2)

Given $\vec{MX} = \lambda \vec{MN}$ and that $\vec{OX} = \mu \vec{OB}$,

(b) use a vector method to find the value of λ and the value of μ .

(8)

(c) Hence find, in its simplest form, the ratio

Area of quadrilateral $OXNC$: Area of parallelogram $OABC$.

(3)

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Question 10 continued

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Question 10 continued

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Question 10 continued

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(Total for Question 10 is 13 marks)



11

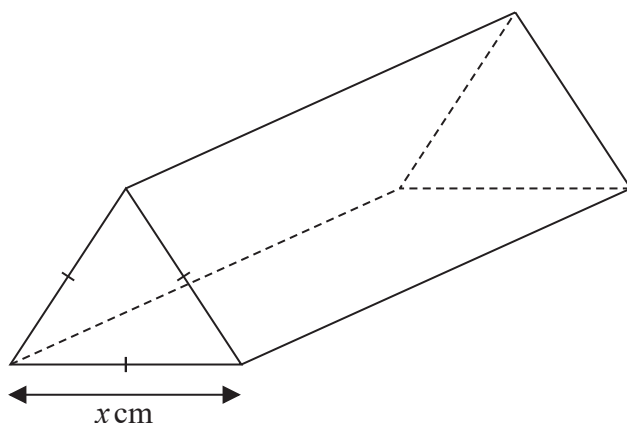


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Figure 4

A company manufactures chocolate bars that are inside packaging that is in the shape of a right triangular prism.

The cross section of the prism is an equilateral triangle with sides of length x cm, as shown in Figure 4.

The volume of the prism is 72 cm^3

The total surface area of the prism is $S \text{ cm}^2$

(a) Show that

$$S = \frac{\sqrt{3}x^2}{2} + \frac{288\sqrt{3}}{x} \tag{6}$$

Given that x can vary,

(b) use calculus to find, to 4 significant figures, the value of x for which S is a minimum, justifying that this value gives a minimum value of S . (5)

(c) Find, to 3 significant figures, the minimum value of S . (2)

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Question 11 continued

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Question 11 continued

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(Total for Question 11 is 13 marks)

TOTAL FOR PAPER IS 100 MARKS

